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(71)Applicant : SEIKO EPSON CORP

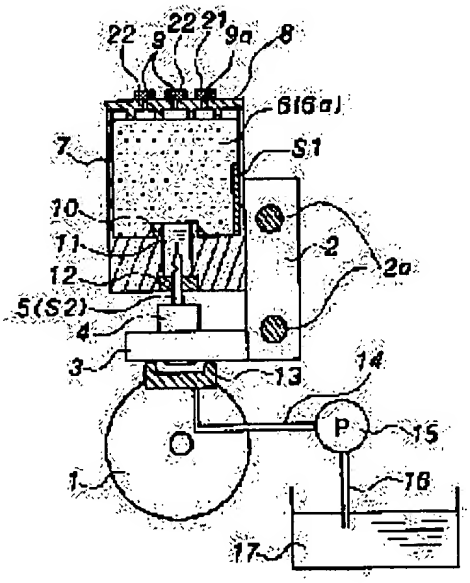
(72)Inventor : KOBAYASHI TAKAO
KANETANI MUNEHIDE
MIYAZAWA HISASHI
MOCHIZUKI SEIJI
KOIKE HISASHI
SUDA KOJI

## (54) INK JET RECORDING APPARATUS AND INK TANK AND MANUFACTURE THEREOF

(57)Abstract:

PURPOSE: To provide an ink jet recording apparatus capable of keeping the reliability even in the case of separating the recording head and ink tank.

CONSTITUTION: The ink jet recording apparatus comprises a communication part including an ink reservoir 6, an ink chamber 11 communicating to the recording head 3, and a blank cap 12, one or a plurality of communicating holes 9 made to communicate to the outside, and an impervious sealing member 21 for sealing each communicating holes 9 to be a decompressed state and permitting at least one to be openable immediately before being mounted on the ink jet recording apparatus, and further it comprises a vessel to be wrapped by making a space and in a decompressed state.

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(71)出願人　000002369
セイコーエプソン株式会社
東京都新宿区西新宿２丁目４番１号

(72)発明者　小林　隆男
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　金谷　宗秀
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　宮澤　久
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(74)代理人　弁理士　鈴木　喜三郎　（外１名）

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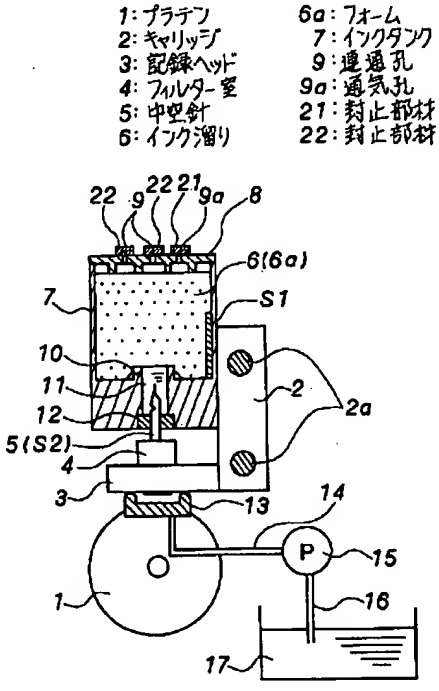
(54)【発明の名称】　インクジェット記録装置及びインクタンクとその製造方法

(57)【要約】

【目的】　記録ヘッドとインクタンクとを分離しても信頼性の高いインクジェット記録装置を提供する。

【構成】　インク溜り６と記録ヘッド３に連通するインク室１１及び盲栓１２よりなる連通部と、外部と連通するが如く穿たれた１個ないし複数個の連通孔９と、各々の連通孔９を減圧状態となるよう封止し、少なくとも１個がインクジェット記録装置に装填する直前に開封可能である非通気性の封止部材２１から構成され、さらに空間を設けて減圧状態で包装される容器２５からなる。



【特許請求の範囲】
【請求項１】　インクタンクと、該インクタンクと連通部材を介して連通するインクジェット式記録ヘッドを有するインクジェット記録装置において、
前記インクタンクは、インク溜りと、該インク溜りと前記記録ヘッドに連通する連通部と、外部と連通するが如く穿たれた１個ないし複数個の連通孔と、各々の前記連通孔を減圧状態となるよう封止し、少なくとも１個が前記インクジェット記録装置に装填する直前に開封可能である非通気性の封止部材から構成され、さらに空間を設けて減圧状態で包装される容器からなることを特徴とするインクジェット記録装置。
【請求項２】　ノズルよりインク滴を吐出し記録紙に記録を行うインクジェット記録装置に装填し、記録ヘッドにインクを供給するインクタンクにおいて、該インクタンクは、インク溜りと、該インク溜りと前期記録ヘッドに連通する連通部と、外部と連通するが如く穿たれた１個ないし複数個の連通孔と、各々の該連通孔を減圧状態となるよう封止し、少なくとも１個が前記インクジェット記録装置に装填する直前に開封可能である非通気性の封止部材から構成され、さらに空間を設けて減圧状態で包装される容器からなることを特徴とするインクタンク。
【請求項３】　インクジェット記録装置に用いる、インク溜りと、外部と連通するが如く穿たれた連通孔と、前記インク溜りと前記インクジェット記録装置に連通する連通部を有するインクタンクの製造方法において、
Ａ．前記連通孔を通じて前記インク溜りを減圧する工程
Ｂ．インクを前記連通孔から前記インクタンクに供給し充填する工程
Ｃ．少なくとも１個が開封可能である非通気性の封止部材で、各々の前記連通孔のうち、少なくとも１個はインク溜りが減圧状態となるよう、減圧し密封をする工程
Ｄ．前記インクタンクを通気性のない容器内に入れ、該容器内を減圧し密封包装する工程
からなることを特徴とするインクタンクの製造方法。
【請求項４】　前記ＣとＤの工程が、０．０２～０．０５ＭＰａのほぼ同圧下で行われることを特徴とする請求項３記載のインクタンクの製造方法。
【請求項５】　前記連通孔の少なくとも１個を、大気圧下で非密封に封止部材を仮止めし、減圧状態で本止めし、さらに容器内に減圧状態で密封にする工程からなることを特徴とする請求項３記載のインクタンクの製造方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明はノズルよりインク滴を吐出して記録紙上に文字などの記録を行うインクジェット記録装置に関する。
【０００２】
【従来の技術】ノズルよりインク滴を吐出させて記録紙上に、記録情報に応じた文字などの記録書き込みを行うインクジェット記録装置では、微細なノズルからインクを吐出してインク滴を形成する。インク滴の形成は記録ヘッド内部に配設された圧力室を電気歪振動子、電気熱変換素子等により急激に容積変化させ、吐出圧力を発生することで行われる。そのためインク供給経路内に空気が混入した場合には、吐出圧力が良好に発生せず、記録書き込みが不能となる。
【０００３】さらに、インクタンク内のインクが消費され尽くして供給が断たれると、記録書き込みが不能になる。そして、ノズルに至るインク供給経路内に空気が入り込み、インクを新たに補給しても記録書き込みが可能になるまでに、多大の時間とインクがかかってしまうといった問題が生じる。
【０００４】もとより、このような問題に対処するために、インクタンク内にレベル検出器を配設し、またはインク供給経路の一部にレベル検出器を配設しインクの供給が断たれる前にインクエンドを検出する構成が用いられている。それによりインクエンド時にインク供給経路内に空気が大量に混入することを防止している。しかしながらインクタンクの交換時等のインクタンクと記録ヘッドとの抜き差し時にインク供給経路内に空気が混入することを完全に防止することはできない。
【０００５】そこで従来よりインク供給経路内に混入した空気の影響を、インクタンクと記録ヘッドとの抜き差し時に初期的に抑えるための提案として、特公平３－６１５９２号公報に記載されたものなどが知られている。ガスバリア性の極めて高い密封容器内に、脱気したインクを収容したインクタンクを減圧状態で収容したものである。この従来例では、密封容器を開封直後はインクタンク内のインクは脱気インクとなっており、この脱気インクによりインク供給経路内に混入した空気の影響を初期的に除去しようとするものである。
【０００６】しかし、この密封容器構造は、インクタンクの姿勢差、位置、接続性等で、自由度がなく、複雑である。またキャリッジの動作に伴って、インクが激しく揺動し、記録ヘッドの吐出特性に不具合を生ずる。
【０００７】これを解決するために、多孔質部材を収納したインクタンクが提案されている。このインクタンクには、インクを充填するための注入孔や、インクの使用による減少に対応して空気が流入するように、大気と連通するための通気孔を有する。
【０００８】また前記のように脱気インクにするため、減圧状態でインクを充填し、さらに、インクタンクを減圧状態で容器内に包装させる。
【０００９】
【発明が解決しようとする課題】しかし従来例では、インクの表面張力が比較的高くて、泡立ちにくい場合はよいが、より減圧度が大きく、脱気度を保ち、信頼性を高

めようとした場合、あるいはインクの表面張力が低く、泡立ちやすい場合には、インクが注入孔から漏れやすくなる。また、落としたりといった衝撃を加えた後に減圧包装すると、僅かな減圧でインクが漏れるので作業性が悪い。さらに温度変化があるとインク中の気体の膨張で、インクが漏れる。インクの漏れを防止するためにインクの充填量を減らして充填効率を落とすとインクタンクが大きくなるといった問題がある。

【００１０】また、インクタンク中に空間を設けたり、蓋の形状を工夫して漏れの対策をしても、高温環境下ではインク中の気体が膨張して漏れてしまい、これを完全に防ぐことは難しい上に、インクタンクが大きくなるといった問題がある。

【００１１】そこで本発明はこのような問題点を解決するものでその目的とするところは、信頼性が高く小型のインクジェット記録装置を提供することにある。

【００１２】

【課題を解決するための手段】本発明のインクジェット記録装置は、インクタンクから連通部材を介してインクを供給し、ノズルよりインク滴を吐出し記録紙に記録を行うインクジェット記録装置において、インクタンクは、インク溜りと、インク溜りと記録ヘッドに連通する連通部と、外部と連通するが如く穿たれた１個ないし複数個の連通孔と、各々の該連通孔を減圧状態となるよう封止し、少なくとも１個がインクジェット記録装置に装填する直前に開封可能である非通気性の封止部材から構成され、さらに空間を設けて減圧状態で包装される容器からなることを特徴とする。

【００１３】本発明のインクタンクは、ノズルよりインク滴を吐出し記録紙に記録を行うインクジェット記録装置に装填し、記録ヘッドにインクを供給するインクタンクにおいて、インクタンクは、インク溜りとインク溜りと記録ヘッドに連通する連通部と、外部と連通するが如く穿たれた１個ないし複数個の連通孔と、各々の該連通孔を減圧状態となるよう封止し、少なくとも１個がインクジェット記録装置に装填する直前に開封可能である非通気性の封止部材から構成され、さらに空間を設けて減圧状態で包装される容器からなることを特徴とする。

【００１４】本発明のインクタンクの製造方法は、インクジェット記録装置に用いる、インク溜りと、外部と連通するが如く穿たれた連通孔と、インク溜りとインクジェット記録装置に連通する連通部を有するインクタンクの製造方法において、

Ａ．連通孔を通じて該インク溜りを減圧する工程

Ｂ．インクを連通孔からインクタンクに供給し充填する工程

Ｃ．少なくとも１個が開封可能である非通気性の封止部材で、各々の連通孔のうち、少なくとも１個はインク溜りが減圧状態となるよう、減圧し密封をする工程

Ｄ．インクタンクを通気性のない容器内に入れ、容器内を減圧し密封包装する工程

からなることを特徴とする。

【００１５】また前記ＣとＤの工程が、０．０２～０．０５ＭＰａのほぼ同圧下で行われることを特徴とする。

【００１６】さらに連通孔の少なくとも１個を、大気圧下で非密封に封止部材を仮止めし、減圧状態で本止めし、容器内に減圧状態で密封にする工程からなることを特徴とする。

【００１７】

【作用】本発明の上記の構成によれば、インクタンクを減圧状態で密封することから、インクが再脱気されるとともに、減圧包装時や輸送時や保存状態でのインクの漏れがなくなる。またインクタンクと密封容器間に空間を設けて減圧包装したので、インクタンク内部よりインクの分解で発生したガスも、ケースを通して徐々に減圧包装内に吸収され、それによりインクタンクの使用初期に大変信頼性の高い状態に脱気される。これによりインクタンクの交換時にインク供給路内に混入してしまう空気による不具合を解消する。

【００１８】また減圧されたインクタンクを包装前に目視確認できることから、インク漏れ、ケースの変形等の工程検査が容易になる。

【００１９】さらに、非通気性の封止部材で、インクタンク７の上面を覆うことにより、実使用時のインク蒸発を最小限に抑えられる。

【００２０】

【実施例】以下に本発明の一実施例を図面にもとづいて説明する。

【００２１】図１は本発明のインクジェット記録装置の一実施例を説明するための主要断面図であり、図２は本発明のインクジェット記録装置に用いるインクタンクの主要部の分解斜視図である。図３は主要部の斜視図を示したものである。また図４は、インクエンド検出回路を説明するためのブロック図である。記録紙を搬送するために矢印Ａ方向に回転する記録紙搬送手段であるプラテン１に沿って、ガイド軸２ａ上を矢印Ｂ方向に往復運動するキャリッジ２には、プラテン１に近接して記録ヘッド３が一体的に設けられている。記録ヘッド３の上方には、インク溜り６があり内部にポリウレタンフォーム等の多孔質部材よりなるフォーム６ａを収容したインクタンク７が設けられている。本実施例においてインクタンク７は６Ｙ，６Ｍ，６Ｃの３つの部屋に分割されて、インク溜り６は３つ設けられている。この部屋各々にはイエロー、シアン、マゼンタのカラーインクが充填されている。ただしインクの種類と数が設計上変わればインクタンク７内の部屋数は必要数に分割されることになる。インクタンク７には、その蓋８に外部と連通する連通孔９が設けられ、またその底面にはフォーム６ａとの密着をはかる台状の突起１０が形成されている。この突起１０の中心部から下方に向けて記録ヘッド３に連通する連

通部がある。連通部はフォーム６ａ内のインクを取り出し保持するインク室１１と、インク室１１の端部にゴム等の弾性部材よりなる盲栓１２により形成されている。そして、この盲栓１２にフィルタ室４を介して、記録ヘッド３と連通する連通部材である中空針５を挿通することにより、インクタンク７内に含浸したインクを記録ヘッド３に供給するように構成されている。なお、インク室１１は盲栓１２及びフォーム６ａにより密閉室の状態になっている。また、連通孔９の少なくとも１つは開封可能な非通気性の封止部材２１で使用直前までは封止されていて、使用直前に開封して通気孔９ａとなる。但し、本実施例では連通孔９は複数個設けてあるが、各部屋１つだけでも所望の効果を得るのに何等問題はない。開封するためには図２のように充分に長い封止部材２１を用い、その端部を引っ張り剥して開封する方法を用いると容易に開封できる。さらに、その端部を容器２５内に接合すれば容器２５から取り出すときに必ず開封され、使用者の開封忘れなどの問題もなく確実に開封できる。また図５のようにインクタンクを取り付けるためのレバー３０に突起３１を設け、インクタンクを取り付けるときにレバー３０をＣ方向に倒し、この突起３１で突き破る方法を用いても容易に開封できる。但し、封止部材２１を開封できる構成であれば、特に専用の器具を用いて開封しなくてもよい。開封しない他の連通孔９にも非通気性の封止部材２２を設けてある。

【００２２】ここで封止部材２１を開封して通気孔９ａを開ける理由を説明する。全ての封止部材２１，２２は非通気性のため、通常のプリンタ使用のインク消費スピードに対して、インクタンク内に補充される空気量が少ないので、プリンタを使用するにつれて徐々にインクタンク内が負圧になる。この負圧が一定値を越えると、つまりヘッドのノズルに形成されるインクのメニスカスの毛細管力を越える負圧がインクタンク内に発生すると、メニスカスは破壊しインク滴の吐出不良となってしまう。従って、インクの消費に対応して空気を補充するための通気孔９ａが必要となる。

【００２３】また万一、記録ヘッド３に吐出不良が生じた場合には、キャップ１３、配管１４を介して吸引ポンプ１５を動作することで、記録ヘッド３よりインクを吸引する。それにより、吐出不良の回復動作が行われる。吸引されたインクは配管１６を通って廃インク溜１７に送られる。本発明においては、廃インク溜１７とインクタンク７とは別体であって廃インク溜１７は記録装置本体内に配設され、通常は交換されない構成になっている。

【００２４】ところで図中符号Ｓ１，Ｓ２は、インクエンド検出用の電極であって、その一方の電極Ｓ１はフォーム６ａと接触するようにインクタンク７の内壁面に設けられ、他方の電極Ｓ２は、インクと接触する中空針５が電極を兼ねている。電極Ｓ１とインクタンク７の間には、インクが漏れないようにゴム製のＯリング２４がかませてある。そして電極Ｓ１には、図４に示したように基準電圧Ｖｃｃが印可される。また他方の電極Ｓ２を兼ねる中空針５は接地されている。さらに基準電圧Ｖｃｃが印可されている側の電極Ｓ１には、微分回路１９と比較回路２０とからなる抵抗変化量検出回路が接続している。そして抵抗変化量がある一定レベルを越えたときに、出力信号を発生するように構成されている。

【００２５】また記録ヘッド３に印可されるインク滴吐出用の記録指令信号は、可とう性の信号伝達手段であるＦＰＣ（Ｆｌｅｘｉｂｌｅ　Ｐｒｉｎｔ　Ｃｉｒｃｕｉｔ）１８により伝達される。そしてＦＰＣ１８上にはインクエンド検出用の信号線が一体的に配線され、電極Ｓ１，Ｓ２に接続されている。なお、信号伝達手段としてＦＰＣ１８の換わりに、ＦＦＣ（Ｆｌｅｘｉｂｌｅ　Ｆｌａｔ　Ｃａｂｌｅ）等を用いても良いことはいうまでもない。さらに１枚のＦＰＣではなく、２枚重ねの構成であっても良いことはいうまでもない。

【００２６】次に本実施例に用いたインクタンクの製造方法について図６のフローチャートにより説明する。

【００２７】インクタンク組立工程では、前述図２の構成からなるインクタンク７を封止部材２１，２２を残して組み立てる。

【００２８】インク溜まり減圧工程では、インクタンク７のインク溜まり６を連通孔９を通して、０．０４ＭＰａ以下に減圧する。この時の減圧度は、充填インク量及び充填時間を考慮すると０．０２ＭＰａ以下が望ましい。

【００２９】その後、インク充填工程で連通孔９よりインクを充填する。この時インクは減圧され、脱気インクとなる。この減圧状態で多孔質部材にインクを充填する方法については特開昭６０－２４５５６０号公報において開示され説明されているように、インク充填効果は非常に高い方法である。

【００３０】次に大気圧下で連通孔９のうち９ａ以外を封止部材２２で封をする。その後、減圧密封工程でインクタンク７を０．０２～０．０５ＭＰａの減圧下にし、通気孔９ａを封止部材２１で封をする。この減圧下であれば、インクは十分再脱気され、通気孔９ａからのインク漏れはない。減圧度を０．０２ＭＰａ以下にすると、減圧時のインク漏れ、あるいは前述の密封後のわずかな衝撃、姿勢差、環境温度変化等でインク漏れが起きる。

【００３１】封止後大気開放する。この工程は図７のように、封止部材２１の２１ａを大気下で仮止めし、０．０２～０．０５ＭＰａの減圧下で２１ｂ本止めしてもよく、この方が装置上容易である。

【００３２】このようにして密封されたインクタンク７のインクは、充填後の大気開放及び再減圧で、多孔質部材のフォーム６ａに均一に充填されるとともに、再脱気される。

【００３３】封止方法には溶着もしくは接着材による方法などを用いることができるが、インクの漏れを防ぐためには溶着の方が望ましい。接着剤を用いる場合、漏れを防ぐための接着力と剥離性、インクに犯されないといった特性を満足する必要がある。

【００３４】封止部材２１，２２は、非通気性の部材で、ポリエチレンテレフタレート樹脂あるいはアルミラミネートフィルムを主体とし、溶着あるいは接着しやすいようポリスチレン樹脂やポリオレフィン系樹脂等からなる積層フィルムである。

【００３５】次に減圧包装工程では、図８のようにインクタンク７とスペーサ２８を容器２５に入れ０．０２～０．０５ＭＰａに減圧した後、完全にシール部２６をシールし密封包装する。その後大気開放する。

【００３６】インクタンク７と容器２５の間には空間２９がある。この空間２９によって、インクタンク７の輸送中や保存中にインクが分解して窒素や酸素などのガスが発生してもケース壁を通して徐々に脱気される。スペーサ２８に段ボールやウレタンフォームのように空気を透過し、かつその内部に空間が存在する部材を用いれば、もし容器２５が密着しても部材内の空間が空間２９の役割を果たす。またインクタンク７を保護する緩衝材としての役割も果たす。減圧包装時の減圧度は前記封止部材２１の封止時減圧度とほぼ同じ０．０２～０．０５ＭＰａである。これによりインクタンク内と密封容器内の圧力バランスが保たれ、インクタンク７に溶着あるいは接着した封止部材２１、２２の接合強度が小さくても、剥がれることはない。

【００３７】図９に減圧密封包装された密封容器を示す。容器２５は、ガスバリア性の極めて高いアルミラミネートフィルムで作られた包装袋である。

【００３８】さらに梱包工程で梱包箱２７（不図示）に収納される。この状態で容器２５のシール部２６は梱包箱２７との間にあって緩衝材を兼ねている。そのため特別な緩衝部材を用いる必要はない。

【００３９】次に減圧包装時の真空度と減圧包装状態における保存期間後の窒素量との関係を説明する。大気中には窒素以外の気体も存在するが、窒素量が最も大きいため窒素量がコントロールできればよい。

【００４０】実験によれば表１に示すように密封シール時の減圧度を制御することにより、包装を開封した直後のインクタンク７内のインクの脱気度を制御することができる。

【００４１】

【表１】

| 減圧度（ＭＰａ） | 窒素量（％） |
|---|---|
| ０．０５ | ６０～７０ |
| ０．０３５ | ５５～６５ |
| ０．０２ | ４５～６０ |

【００４２】表中の窒素量は、飽和値に対するインク中に溶けている窒素量のパーセンテージで示してあり、本実施例に用いたインクの場合には、飽和値は１０～１１ｐｐｍ程度であった。

【００４３】次に製造時から実使用までのインクタンク内のインク脱気度がどのように変化するかをインク中の窒素量に実験データに基づき図１０で説明する。インク充填後のａ時点で脱気されていたインクは、大気状態に放置されることにより、約３日後のｂ時点で飽和状態に達する。ｃ時点で０．０２～０．０５ＭＰａの減圧下でインクタンク７を非通気性の封止部材２１で密封すると、インクは脱気し、さらにインクタンク７の空間２３にインクに溶解の窒素や酸素が吸収され、ｄ時点の脱気度までになる。その後は、インクが分解して、インク成分中の窒素等のガスが発生することもあり、脱気度が落ちる。ｄ時点までの期間は、周辺環境にもよるが、１日程度であり、ｅ時点には６ヶ月から１年かけて１０～２０％増加していく。ｅ時点で減圧包装すると、インクタンク７のインク脱気度はインクタンク７のケース等を通して徐々に向上する。長期間中に発生するインクからのガスも、空間２９に十分吸収させることができる。ｅ時点からｆ時点までの期間は、包装状態での保存期間であり、実験では２年間を想定した。

【００４４】そして開封後の図中ｆ時点より順次窒素量は上昇する。インク中の窒素量は、開封後３日程で図中ｇの略飽和状態に達する。しかしながら実験によると、脱気による効果は図中ｆの開封後から２～４週間程度期待できることがわかった（図中ｈ）。その後は完全飽和状態となり、本発明で所望するインクの脱気の効果はなくなる。

【００４５】本実験では、各時点まで十分な期間を設けて行ったが、実製造工程では、ａ時点のインク充填後、数時間以内にｃ時点の減圧下封止をし、さらに１日以内にｅ時点の減圧包装を行なうため、図示のようなN2 値の変化は見られず、脱気度が十分保たれた状態で減圧包装される。

【００４６】ここでインクの脱気による効果について説明する。インクタンク７を中空針５に対して抜き差しする際に、中空針５より混入する空気の量は、通常は非常に微量である。実験による確認では、中空針５のインク流入口径が直径０．８ｍｍ程度の時、混入する空気の量は、多くてもメニスカス分の０．４立方ｍｍ程度以下で

あった。一度混入した空気は記録ヘッド３に向かって流れ、フィルタ室４内のフィルタ４ａ（不図示）に到達しトラップされる。このトラップされた空気はフィルタ４ａの目粗さが非常に微細なため容易にフィルタ４ａを通過することはない。実験によればフィルタ４ａの直径が４mm、フィルタ室４内の空間幅が０．３～０．５mm程度の時にインクタンク７の抜き差し回数が１０～数１０回行なっても記録動作によって該空気がフィルタ４ａを通過することはなかった。この程度の空気の混入であれば図１０中ｇまでの期間中は、明らかに脱気インクを記録ヘッド３に供給することができ、それによりインクタンク７を中空針５に対して抜き差しする際に、中空針５より混入した空気はインクにとけ込み問題とはならない。しかしながら実使用においては中空針５よりインクタンク７を外したまま放置される場合などは充分に有り得る。この場合には大量に空気が混入する。大量に空気が混入すると混入した空気はフィルタ４ａをふさぎインクの通過を妨げてしまう。その結果として記録ヘッド３は吐出不良となる。この場合には吸引ポンプ１５を動作して吐出不良の回復動作を行うのであるが、インクの脱気度によって回復性に大きな差があることも実験によりわかった。図１０中ｈで示す開封後２～４週間程度までのインクであれば、フィルタ室４内の空気を吸引ポンプ１５により吸引除去するのに何ら不具合はない。ところがこの期間を過ぎるとインク中の空気量は完全飽和、さらには過飽和状態となり、空気と共にフィルタ４ａを通過するとフィルタ４ａから記録ヘッド３にかけて微小気泡が発生することが確認された。この微小気泡が記録ヘッド３の圧力室にある場合には吐出不良となってしまう。

【００４７】以上説明したようにインクタンク７の交換時に混入する空気に対しては、インクの脱気の効果により吐出不良となるような不具合をなくすことが出来る。またフィルタ室４内に多量に空気が溜った場合に行う回復動作においてもインクの脱気の効果により、良好に回復動作を終了することができる。フィルタ室４内の空気量が一定以下であれば空気がインクと共にフィルタ４ａを通過しないため、図１０中ｇ以降の飽和状態となったインクであっても回復動作時になんら不具合はない。

【００４８】

【発明の効果】本発明によれば、インクタンクを減圧状態で密封することから、インクが再脱気されるとともに、減圧包装時や輸送時や保存状態でのインクの漏れがなくなる。またインクタンクと密封容器間に空間を設けて減圧包装したので、インクタンク内部よりインクの分解で発生したガスも、ケースを通して徐々に減圧包装内に吸収され、それによりインクタンクの使用初期に大変信頼性の高い状態に脱気されたインクを記録装置に供給することができる。これによりインクタンクの交換時にインク供給路内に混入してしまう空気による不具合を解消する。

【００４９】また減圧されたインクタンクを包装前に目視確認できることから、インク漏れ、ケースの変形等の工程検査が容易になる。

【００５０】さらに、非通気性の封止部材で、インクタンク７の上面を覆うことにより、実使用時のインク蒸発を最小限に抑える効果もある。

【００５１】以上により極めて信頼性が高く小型のインクジェット記録装置を提供できる。

【図面の簡単な説明】

【図１】本発明のインクジェット記録装置の一実施例を説明するための主要断面図。

【図２】本発明のインクジェット記録装置に用いるインクタンクの主要部の分解斜視図。

【図３】本発明のインクジェット記録装置の主要部の斜視図。

【図４】インクエンド検出回路を説明するためのブロック図。

【図５】本発明のインクジェット記録装置の主要部の斜視図。

【図６】本発明の製造工程を説明するフローチャート。

【図７】本発明の封止部材による封止を説明する斜視図。

【図８】減圧包装容器内を説明するための断面図。

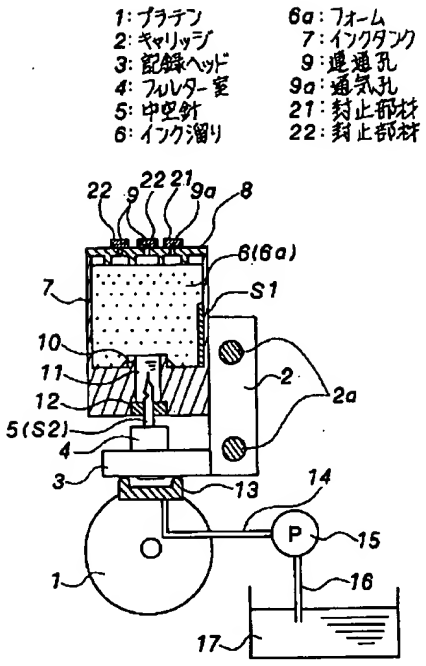
【図９】減圧包装されたインクタンクを説明するための斜視図。

【図１０】窒素量と時間の関係を示した図。

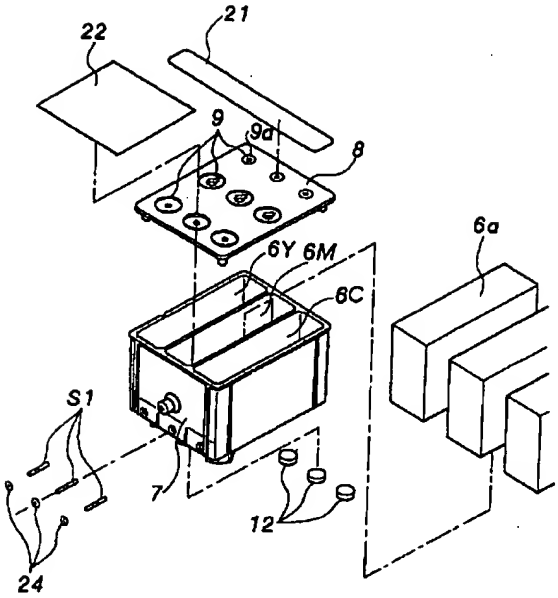
【符号の説明】

３　・・・・記録ヘッド
６　・・・・インク溜まり
６ａ・・・・フォーム
７　・・・・インクタンク
９　・・・・連通孔
９ａ・・・・通気孔
２１・・・・封止部材
２２・・・・封止部材
２３・・・・空間
２５・・・・容器
２６・・・・シール部
２８・・・・スペーサ
２９・・・・空間

【図１】

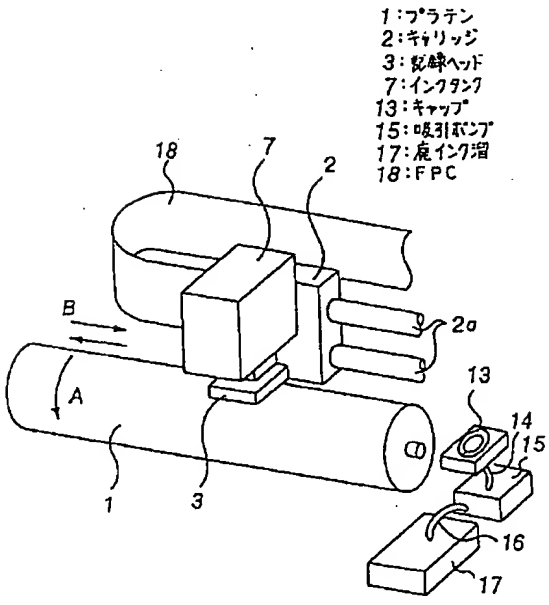

1：プラテン
2：キャリッジ
3：記録ヘッド
4：フィルター室
5：中空針
6：インク溜り
6a：フォーム
7：インクタンク
9：連通孔
9a：通気孔
21：封止部材
22：封止部材
22
9
22
21
9a
8
6(6a)
7
S1
10
11
12
5(S2)
4
3
13
14
P
15
1
16
17
2
2a

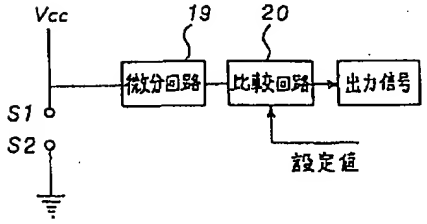
【図２】


22
21
9
9a
8
6a
6Y
6M
6C
S1
7
12
24

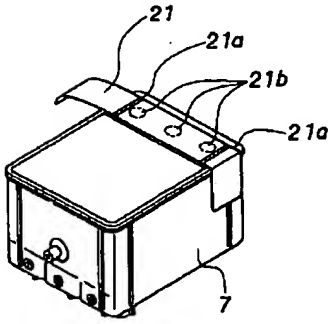
【図４】

【図３】

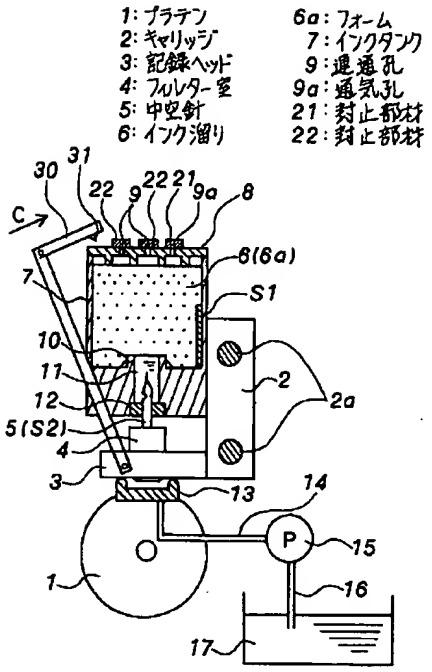

1：プラテン
2：キャリッジ
3：記録ヘッド
7：インクタンク
13：キャップ
15：吸引ポンプ
17：廃インク溜
18：FPC
18
7
2
B
A
2a
13
14
15
1
3
16
17


Vcc
19
20
S1
S2
微分回路
比較回路
出力信号
設定値

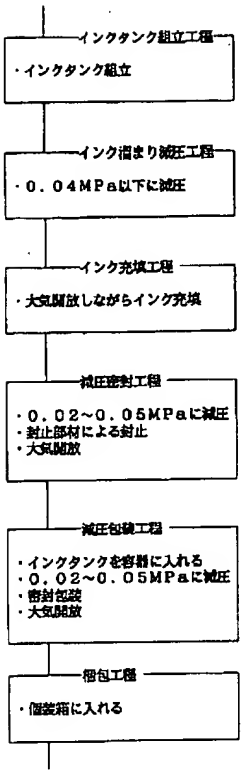
【図７】


21
21a
21b
21a
7

【図５】


1: プラテン
2: キャリッジ
3: 記録ヘッド
4: フィルター室
5: 中空針
6: インク溜り
6a: フォーム
7: インクタンク
9: 連通孔
9a: 通気孔
21: 封止部材
22: 封止部材
30
31
22
9
22
21
9a
8
C
8(6a)
7
S1
10
11
12
5(S2)
4
3
2
2a
13
14
P
15
16
1
17

【図６】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・インクタンク組立
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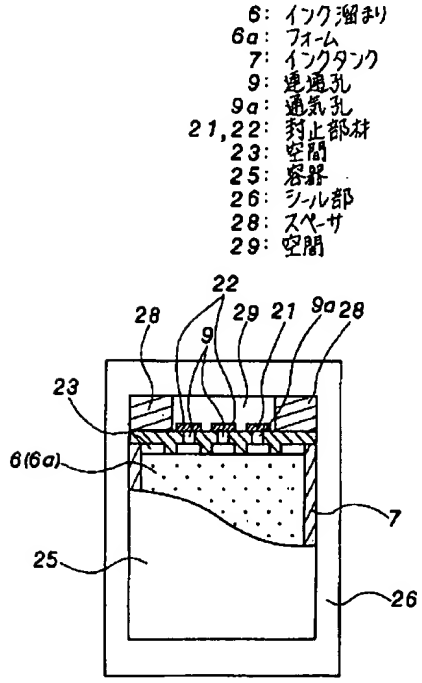
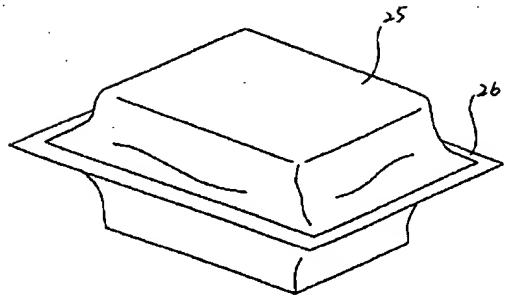
・0．04MPa以下に減圧
インク充填工程
・大気開放しながらインク充填
減圧密封工程
・0．02～0．05MPaに減圧
・封止部材による封止
・大気開放
減圧包装工程
・インクタンクを容器に入れる
・0．02～0．05MPaに減圧
・密封包装
・大気開放
梱包工程
・個装箱に入れる

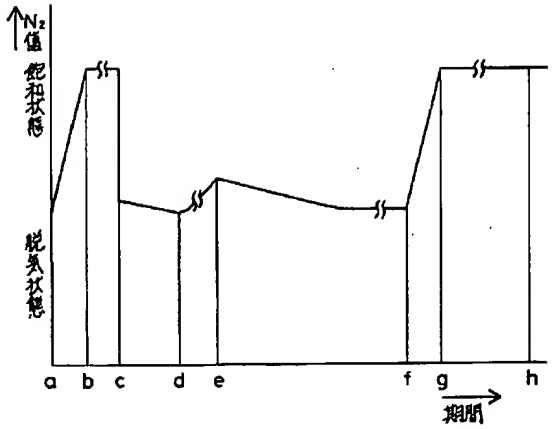
【図８】


6: インク溜まり
6a: フォーム
7: インクタンク
9: 連通孔
9a: 通気孔
21,22: 封止部材
23: 空間
25: 容器
26: シール部
28: スペーサ
29: 空間
22
28
29
21
9a
28
9
23
6(6a)
7
25
26

【図９】


25
26

【図１０】

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フロントページの続き

(72)発明者　望月　聖二
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　小池　尚志
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

(72)発明者　須田　幸治
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

## CLAIMS

[Claim(s)]
[Claim 1] In an ink tank, this ink tank, and the ink jet recording device that has the ink jet type recording head which is open for free passage through a free passage member said ink tank Ink ****, this ink ****, and the free passage section that is open for free passage to said recording head, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and each the hole of said free passage are closed so that it may be in a reduced pressure condition. The ink jet recording device characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads said ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[Claim 2] In the ink tank which loads with an ink droplet the ink jet recording device which records on the discharge detail paper, and supplies ink to a recording head from a nozzle this ink tank Ink ****, this ink ****, and the free passage section that is open for free passage to a recording head in the first half, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and this each free passage hole are closed so that it may be in a reduced pressure condition. The ink tank characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads said ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[Claim 3] In the manufacture approach of an ink tank of having the free passage section which is open for free passage to ink **** used for an ink jet recording device, the free passage hole dug so that it might be open for free passage with the exterior, and said ink **** and said ink jet recording device A. -- process C. which supplies and fills up said ink tank with the process B. ink which decompresses said ink **** through said free passage hole from said free passage hole -- by the closure member of the non-permeability which can open at least one piece It is the manufacture approach of the ink tank characterized by at least one in each the hole of said free passage consisting of a process which puts in the process D. aforementioned ink tank which seals by decompressing in a container without permeability so that ink **** may be in a reduced pressure condition, decompresses the inside of this container, and carries out a seal package.
[Claim 4] The manufacture approach of an ink tank according to claim 3 that said process of C and D is characterized by the thing of 0.02-0.05MPa mostly performed by this draft.
[Claim 5] The manufacture approach of the ink tank according to claim 3 characterized by consisting of a process which carries out this stop of the closure member to un-sealing in the state of a tacking meal and reduced pressure under atmospheric pressure, and makes seal further at least one of said free passage hole in the state of reduced pressure into a container.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the ink jet recording device which breathes out

an ink droplet and records an alphabetic character etc. in the record paper from a nozzle.
[0002]
[Description of the Prior Art] From a nozzle, an ink droplet is made to breathe out, with the ink jet recording device which performs record writing, such as an alphabetic character according to recording information, ink is breathed out in the record paper from a detailed nozzle, and an ink droplet is formed in it. Formation of an ink droplet carries out volume change of the pressure room arranged in the interior of a recording head rapidly by electrostriction vibrator, an electric thermal-conversion component, etc., and is performed by generating a discharge pressure. Therefore, when air mixes in an ink supply path, a discharge pressure does not occur good but record writing becomes impossible.
[0003] Furthermore, record writing will become impossible, if all the ink in an ink tank is consumed and supply is cut off. And air enters in the ink supply path of resulting in a nozzle, and the problem of applying a great quantity of time amount and ink by the time record writing is attained, even if it newly supplies ink arises.
[0004] In order to cope with such a problem from the first, before arranging a level detector in an ink tank, or arranging a level detector in a part of ink supply path and cutting off supply of ink, the configuration which detects an ink end is used. It has prevented that air mixes in a large quantity in an ink supply path by that cause at ink and the time. However, it cannot prevent thoroughly that air mixes in an ink supply path at the time of extraction and insertion with the ink tanks at the time of exchange of an ink tank etc., and a recording head.
[0005] Then, what was indicated by JP,3-61592,B is known as a proposal for suppressing the effect of the air conventionally mixed in the ink supply path in first stage at the time of extraction and insertion with an ink tank and a recording head. The ink tank which held the deaerated ink in the very high hermetic container of gas barrier property is held in the state of reduced pressure. In this conventional example, immediately after opening a hermetic container, the ink in an ink tank is deaeration ink, and it is going to remove the effect of the air mixed in the ink supply path in this deaeration ink in first stage.
[0006] However, it is the position difference of an ink tank, a location, connectability, etc., and this hermetic container structure does not have a degree of freedom, and is complicated. Moreover, with actuation of carriage, ink rocks violently and produces nonconformity in the regurgitation property of a recording head.
[0007] In order to solve this, the ink tank which contained the porosity member is proposed. On this ink tank, it has an injected hole for being filled up with ink, and an air hole for being open for free passage with atmospheric air so that air may flow corresponding to reduction by the activity of ink.
[0008] Moreover, in order to make it deaeration ink as mentioned above, ink is filled up with a reduced pressure condition and an ink tank is made to pack in a container in the state of reduced pressure further.
[0009]
[Problem(s) to be Solved by the Invention] However, in the conventional example, when whenever [ reduced pressure ] tends to be more large although it was good when the surface tension of ink was comparatively high and it was hard to foam, whenever [ deaeration ] tends to be maintained and it is going to raise dependability, or in the surface tension of ink is low and being easy to foam, ink leakage-comes to be easy from an injected hole. Moreover, if vacuum packaging is carried out after adding the impact of being as drop ****, since ink will leak by slight reduced pressure, workability is bad. If there is furthermore a temperature change, ink will

leak by expansion of the gas in ink. In order to prevent the leakage of ink, when the fill of ink is reduced and a charging efficiency is dropped, there is a problem that an ink tank becomes large.
[0010] Moreover, even if it prepares space into an ink tank, or devises the configuration of a lid and copes with leakage, under hot environments, the gas in ink expands and leaks and preventing this thoroughly has the problem that an ink tank becomes large, in a difficult top.
[0011] Then, the place which this invention solves such a trouble and is made into the object has dependability in offering a small high ink jet recording device.
[0012]
[Means for Solving the Problem] In the ink jet recording device which the ink jet recording device of this invention supplies ink through a free passage member from an ink tank, and records an ink droplet on the discharge detail paper from a nozzle The free passage section which an ink tank opens for free passage to ink ****, ink ****, and a recording head, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and this each free passage hole are closed so that it may be in a reduced pressure condition. It is characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads an ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[0013] In the ink tank which the ink tank of this invention loads with an ink droplet from a nozzle the ink jet recording device which records on the discharge detail paper, and supplies ink to a recording head The free passage section which an ink tank opens for free passage to ink ****, ink ****, and a recording head, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and this each free passage hole are closed so that it may be in a reduced pressure condition. It is characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads an ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[0014] Ink **** which uses the manufacture approach of the ink tank of this invention for an ink jet recording device, In the manufacture approach of an ink tank of having the free passage section which is open for free passage to the free passage hole dug so that it might be open for free passage with the exterior, and ink **** and an ink jet recording device A. -- process C. which supplies and fills up an ink tank with the process B. ink which decompresses this ink **** through a free passage hole from a free passage hole -- by the closure member of the non-permeability which can open at least one piece It is characterized by consisting of a process which at least one piece puts in the process D. ink tank which seals by decompressing so that ink **** may be in a reduced pressure condition in a container without permeability, decompresses the inside of a container, and carries out a seal package among each free passage holes.
[0015] Moreover, said process of C and D is characterized by the thing of 0.02-0.05MPa mostly performed by this draft.
[0016] It is characterized by consisting of a process which carries out this stop of the closure member to un-sealing in the state of a tacking meal and reduced pressure under atmospheric pressure, and furthermore makes seal at least one of a free passage hole in the state of reduced pressure into a container.
[0017]
[Function] Since an ink tank is sealed in the state of reduced pressure, while ink is re-deaerated according to the above-mentioned configuration of this invention, the leakage of the ink in the time of vacuum packaging and transport or a state of preservation is lost. Moreover, since

vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container, from the interior of an ink tank, the gas which occurred in disassembly of ink is also gradually absorbed in vacuum packaging through a case, and, thereby, is deaerated by the very reliable condition in early stages of the activity of an ink tank. Nonconformity with the air which this mixes in an ink supply way at the time of exchange of an ink tank is canceled.
[0018] Moreover, since it can inspect visually before packing the decompressed ink tank, inspection between processes, such as ink leakage and deformation of a case, becomes easy.
[0019] Furthermore, the ink evaporation at the time of a real activity can be suppressed by covering the top face of the ink tank 7 by the closure member of non-permeability to the minimum.
[0020]
[Example] One example of this invention is explained based on a drawing below.
[0021] Drawing 1 is a main sectional view for explaining one example of the ink jet recording apparatus of this invention, and drawing 2 is the decomposition perspective view of the body of the ink tank used for the ink jet recording apparatus of this invention. Drawing 3 shows the perspective view of the body. Moreover, drawing 4 is a block diagram for explaining ink and a detector. A platen 1 is approached and the recording head 3 is formed in the carriage 2 which reciprocates a guide shaft 2a top in the direction of arrow-head B along with the platen 1 which is a recording paper conveyance means to rotate in the direction of arrow-head A in order to convey the recording paper in one. The ink tank 7 which held form 6a which there is ink **** 6 and becomes the interior from porosity members, such as polyurethane foam, is formed above the recording head 3. In this example, the ink tank 7 is divided into three chambers, 6Y, 6M, and 6C, and three ink **** 6 are formed. These chambers of each are filled up with yellow, cyanogen, and the color ink of a Magenta. However, if the class and number of ink change on a design, the number of chambers in the ink tank 7 will be divided into a required number. The exterior and the free passage hole 9 open for free passage are formed in the lid 8, and the base-like projection 10 which aims at adhesion with form 6a is formed in the base at the ink tank 7. There is the free passage section which turns caudad from the core of this projection 10, and is open for free passage to a recording head 3. The free passage section is formed in the edge of the ink room 11 which carries out ejection maintenance of the ink in form 6a, and the ink room 11 by the plug 12 which consists of elastic members, such as rubber. And by inserting in this plug 12 the hollow needle 5 which are a recording head 3 and a free passage member open for free passage through the filter room 4, it is constituted so that the ink which sank in into the ink tank 7 may be supplied to a recording head 3. In addition, the ink room 11 is in the condition of a sealing room by the plug 12 and form 6a. Moreover, it is closed till just before an activity by the closure member 21 of the non-permeability which at least one can open of the free passage hole 9, opens just before an activity, and is set to air hole 9a. However, although two or more free passage holes 9 are formed in this example, it is satisfactory for acquiring desired effectiveness at least each one chamber in any way. If the approach of pulling, removing and opening the edge using the closure member 21 long enough like drawing 2 is used in order to open, it can open easily. Furthermore, if the edge is joined into a container 25, when taking out from a container 25, it is surely opened, and there are also no problems, such as an opening failure of a user, and it can open certainly. Moreover, projection 31 is formed in the lever 30 for attaching an ink tank like drawing 5 , and when attaching an ink tank, even if it uses the approach of breaking through a lever 30 by the derrick down and this projection 31 in the direction of C, it can open easily. However, if it is the configuration that the closure member 21 can be opened, it is not necessary

to open using the instrument of dedication especially. The closure member 22 of non-permeability is formed in other free passage holes 9 which are not opened.
[0022] The reason for opening the closure member 21 here and opening air hole 9a is explained. The inside of an ink tank becomes negative pressure gradually as all the closure members 21 and 22 use a printer, since there are few air contents filled up in an ink tank to the ink consumption speed of the usual printer activity because of non-permeability. If this negative pressure exceeds constant value (i.e., if the negative pressure exceeding the capillary tube force of the meniscus of the ink formed in the nozzle of a head occurs in an ink tank), it will destroy and a meniscus will become the poor regurgitation of an ink droplet. Therefore, air hole 9a for filling up air corresponding to consumption of ink is needed.
[0023] Moreover, when the poor regurgitation arises in a recording head 3, ink should be attracted from a recording head 3 in operating a suction pump 15 through cap 13 and piping 14. Thereby, recovery action of the poor regurgitation is performed. The attracted ink is sent to waste ink ** 17 through piping 16. In this invention, waste ink ** 17 and the ink tank 7 are another objects, and waste ink ** 17 is arranged in the body of a recording device, and has the composition of usually not being exchanged.
[0024] By the way, the signs S1 and S2 in drawing are ink and an electrode for detection, the electrode S1 of one of these was formed in the internal surface of the ink tank 7 so that form 6a might be contacted, and the hollow needle 5 with which the electrode S2 of another side contacts ink serves as the electrode. O ring 24 made of rubber makes it have bit so that ink may not leak between an electrode S1 and the ink tank 7. And as shown in drawing 4 , the seal of approval of the reference voltage Vcc is carried out to an electrode S1. Moreover, the hollow needle 5 which serves as the electrode S2 of another side is grounded. Furthermore, the resistance variation detector which consists of a differential circuit 19 and a comparison circuit 20 has connected with the electrode S1 of the side to which the seal of approval of the reference voltage Vcc is carried out. And when fixed level with resistance variation is exceeded, it is constituted so that an output signal may be generated.
[0025] Moreover, the record command signal for expulsion of an ink droplet by which a seal of approval is carried out to a recording head 3 is transmitted by FPC (Flexible Print Circuit)18 which is a flexible signal means of communication. And on FPC18, ink and the signal line for detection are wired in one, and it connects with electrodes S1 and S2. In addition, the thing of FPC18 for which FFC (Flexible Flat Cable) etc. may be used for replacing cannot be overemphasized as a signal means of communication. It cannot be overemphasized that you may be the configuration of the two-sheet pile instead of FPC of one more sheet.
[0026] Next, the flow chart of drawing 6 explains the manufacture approach of the ink tank used for this example.
[0027] Like an ink tank erector, it leaves the closure members 21 and 22 and the ink tank 7 which consists of a configuration of above-mentioned drawing 2 is assembled.
[0028] At an ink ****** reduced pressure process, it lets the free passage hole 9 pass, and ink ****** 6 of the ink tank 7 is decompressed to 0.04 or less MPas. Whenever [ reduced pressure / at this time ] has 0.02 or less desirable MPas, when the amount of restoration ink and an injection time are taken into consideration.
[0029] Then, ink is filled up with an ink restoration process from the free passage hole 9. At this time, ink is decompressed and turns into deaeration ink. An ink packing effect is a very high approach as how to fill up ink with this reduced pressure condition into a porosity member is indicated and explained in JP,60-245560,A.

[0030] Next, ** is carried out except 9a by the closure member 22 among the free passage holes 9 under atmospheric pressure. Then, the ink tank 7 is made into the bottom of reduced pressure of 0.02-0.05MPa at a reduced pressure seal process, and ** is carried out for air hole 9a by the closure member 21. If it is under this reduced pressure, ink will be re-deaerated enough and there will be no ink leakage from air hole 9a. If whenever [ reduced pressure ] is set to 0.02 or less MPas, ink leakage will occur by few impacts after the ink leakage at the time of reduced pressure, or the above-mentioned seal, the position difference, environmental temperature change, etc.
[0031] After [ closure ] atmospheric-air disconnection is carried out. Like drawing 7 , this process may carry out 21b stop of the 21a of the closure member 21 under a tacking meal and reduced pressure of 0.02-0.05MPa under atmospheric air, and is easy this gentleman on equipment.
[0032] Thus, the ink of the sealed ink tank 7 is re-deaerated while homogeneity is filled up with the atmospheric-air disconnection and re-reduced pressure after restoration at form 6a of a porosity member.
[0033] Although the approach by joining or the binder etc. can be used for the closure approach, the joining is more desirable in order to prevent the leakage of ink. When using adhesives, it is necessary to satisfy the adhesive strength for preventing leakage, detachability, and the property of not being committed by ink.
[0034] It is the member of non-permeability, and the closure members 21 and 22 make a subject polyethylene terephthalate resin or an aluminum laminate film, and are joining or a laminated film which consists of polystyrene resin, polyolefine system resin, etc. so that it may be easy to paste up.
[0035] Next, in a reduced pressure packaging process, after putting the ink tank 7 and a spacer 28 into a container 25 like drawing 8 and decompressing to 0.02-0.05MPa, the seal of the seal section 26 is carried out thoroughly, and a seal package is carried out. Atmospheric-air disconnection is carried out after that.
[0036] Space 29 is between the ink tank 7 and a container 25. Even if ink decomposes during transport of the ink tank 7 and preservation and gas, such as nitrogen and oxygen, occurs, it is gradually deaerated through a case wall by this space 29. If the member to which air is penetrated like a corrugated fiberboard or urethane foam to a spacer 28, and space exists in the interior is used, even if a container 25 sticks, the space in a member will play the role of space 29. Moreover, a role of shock absorbing material which protects the ink tank 7 is also played. Whenever [ reduced pressure / at the time of vacuum packaging ] is the almost same 0.02-0.05MPa as whenever [ reduced pressure ] at the time of closure of said closure member 21. Pressure balancing in an ink tank and a hermetic container is maintained by this, and even if the bonding strength of joining or the closure members 21 and 22 which were pasted up is small on the ink tank 7, it does not separate.
[0037] The hermetic container by which the reduced pressure seal package was carried out is shown in drawing 9 . A container 25 is the package bag made from the very high aluminum laminate film of gas barrier property.
[0038] Furthermore, it is contained by the container 27 (un-illustrating) at a packing process. This condition was [ the seal section 26 of a container 25 ] of use in the container 27, and it serves as shock absorbing material. Therefore, it is not necessary to use a special buffer member.
[0039] Next, the relation between the degree of vacuum at the time of vacuum packaging and the nitrogen volume after the retention period in a vacuum-packaging condition is explained. What is

necessary is just to be able to control nitrogen volume, since nitrogen volume is the largest although gases other than nitrogen also exist in atmospheric air.
[0040] According to the experiment, by controlling whenever [ reduced pressure / at the time of a seal seal ] to be shown in a table 1, whenever [ deaeration / of the ink in the ink tank 7 immediately after opening a package ] is controllable.
[0041]
[A table 1]

[0042] The percentage of nitrogen volume which has melted into the ink to a saturation value had shown the nitrogen volume in a table, and, in the case of the ink used for this example, the saturation value was about 10-11 ppm.
[0043] Next, based on experimental data, drawing 10 explains how whenever [ in the ink tank from the time of manufacture to a real activity / ink deaeration ] changes to the nitrogen volume in ink. The ink deaerated at the a event after ink restoration reaches a saturation state by being left in an ambient condition at the b event of about three days after. If the ink tank 7 is sealed by the closure member 21 of non-permeability under reduced pressure of 0.02-0.05MPa at the c event, it will deaerate, nitrogen and oxygen of the dissolution in ink will be further absorbed by the space 23 of the ink tank 7, and ink will become by whenever [ deaeration / at the d event ]. Since ink decomposes and gas, such as nitrogen in an ink component, occurs after that, whenever [ deaeration ] falls. Although the period of d event is based also on a circumference environment, it is about one day and increases 10 to 20% at the e event over one year from six months. If vacuum packaging is carried out at the e event, whenever [ ink deaeration / of the ink tank 7 ] will improve gradually through the case of the ink tank 7 etc. Space 29 can be made to also absorb enough the gas from the ink generated during a long period of time. The period of e event to f event is a retention period in a package condition, and assumed two years in the experiment.
[0044] And nitrogen volume rises one by one from the event among [ after opening / f ] drawing. The nitrogen volume in ink will reach the abbreviation saturation state in [ g ] drawing after opening in about three days. However, according to the experiment, it turned out that the effectiveness by deaeration is expectable about two to four weeks after opening in [ f ] drawing (inside h of drawing). It will be in a perfect saturation state after that, and the effectiveness of deaeration of the ink for which it asks by this invention is lost.
[0045] Although each event established sufficient period and was performed in this experiment, in order to carry out closure at the c event under reduced pressure within several hours after the ink restoration at the a event and to perform vacuum packaging at the e event to a pan within one day in a real production process, it is N2 like a graphic display. A value change is not seen, but vacuum packaging is carried out where whenever [ deaeration ] is maintained enough.
[0046] Here explains the effectiveness by deaeration of ink. In case the ink tank 7 is taken out and inserted to the hollow needle 5, the amount of the air mixed from the hollow needle 5 is very

usually a minute amount. In the check by experiment, when the ink inflow aperture of the hollow needle 5 was a diameter of about 0.8mm, even if there were many amounts of the air to mix, they were below 0.4 cube mm extent for a meniscus. The air mixed once flows toward a recording head 3, and a trap is reached and carried out to filter 4a in the filter room 4 (un-illustrating). Since this air by which the trap was carried out has the very detailed eye granularity of filter 4a, filter 4a is not passed easily. When the diameter of filter 4a was [ the space width of face in 4mm and the filter room 4 ] about 0.3-0.5mm according to the experiment, even if the count of extraction and insertion of the ink tank 7 carried out 10 - ten numbers, this air did not pass filter 4a by record actuation. In case deaeration ink can be clearly supplied to a recording head 3 during the period to the inside g of drawing 10 if it is mixing of air of this level, and this takes out and inserts the ink tank 7 to the hollow needle 5, the air mixed from the hollow needle 5 melts into ink, and does not pose a problem. However, when left removing the ink tank 7 from the hollow needle 5 in a real activity, it is fully possible. In this case, air mixes in a large quantity. The air mixed when air mixed in the large quantity will close filter 4a, and will bar passage of ink. A recording head 3 becomes the poor regurgitation as the result. In this case, although the suction pump 15 was operated and recovery action of the poor regurgitation was performed, the experiment also showed that a big difference was in recoverability by whenever [ deaeration / of ink ]. If it is ink by about two - four weeks after opening shown in [ h ] drawing 10 , there will be no nonconformity in carrying out attraction clearance of the air in the filter room 4 with a suction pump 15 in any way. However, when it passed over this period, and it changed into the supersaturation condition further and filter 4a was passed with air, as for the air content in ink, it was checked full saturation and that apply to a recording head 3 from filter 4a, and minute air bubbles are generated. It will become the poor regurgitation when these minute air bubbles are in the pressure room of a recording head 3.

[0047] To the air mixed at the time of exchange of the ink tank 7 as explained above, nonconformity which becomes poor [ the regurgitation ] according to the effectiveness of deaeration of ink can be abolished. Moreover, also in the recovery action performed when air collects so much in the filter room 4, recovery action can be ended good according to the effectiveness of deaeration of ink. If the air content in the filter room 4 is below fixed, in order that air may not pass filter 4a with ink, even if it is ink used as the saturation state after among [ g ] drawing 10 , there is no nonconformity in any way at the time of recovery action.

[0048]

[Effect of the Invention] Since an ink tank is sealed in the state of reduced pressure, while ink is re-deaerated according to this invention, the leakage of the ink in the time of vacuum packaging and transport or a state of preservation is lost. Moreover, since vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container, the gas which occurred in disassembly of ink from the interior of an ink tank is also gradually absorbed in vacuum packaging through a case, and can supply the ink deaerated by the very reliable condition in early stages of the activity of an ink tank by that cause to a recording device. Nonconformity with the air which this mixes in an ink supply way at the time of exchange of an ink tank is canceled.

[0049] Moreover, since it can inspect visually before packing the decompressed ink tank, inspection between processes, such as ink leakage and deformation of a case, becomes easy.

[0050] Furthermore, it is effective in suppressing the ink evaporation at the time of a real activity to the minimum by covering the top face of the ink tank 7 by the closure member of non-permeability.

[0051] An ink jet recording device with it can be offered by the above. [ it is reliable and very, small ]

## TECHNICAL FIELD

[Industrial Application] This invention relates to the ink jet recording device which breathes out an ink droplet and records an alphabetic character etc. in the record paper from a nozzle.
[0002]

## PRIOR ART

[Description of the Prior Art] From a nozzle, an ink droplet is made to breathe out, with the ink jet recording device which performs record writing, such as an alphabetic character according to recording information, ink is breathed out in the record paper from a detailed nozzle, and an ink droplet is formed in it. Formation of an ink droplet carries out volume change of the pressure room arranged in the interior of a recording head rapidly by electrostriction vibrator, an electric thermal-conversion component, etc., and is performed by generating a discharge pressure. Therefore, when air mixes in an ink supply path, a discharge pressure does not occur good but record writing becomes impossible.
[0003] Furthermore, record writing will become impossible, if all the ink in an ink tank is consumed and supply is cut off. And air enters in the ink supply path of resulting in a nozzle, and the problem of applying a great quantity of time amount and ink by the time record writing is attained, even if it newly supplies ink arises.
[0004] In order to cope with such a problem from the first, before arranging a level detector in an ink tank, or arranging a level detector in a part of ink supply path and cutting off supply of ink, the configuration which detects an ink end is used. It has prevented that air mixes in a large quantity in an ink supply path by that cause at ink and the time. However, it cannot prevent thoroughly that air mixes in an ink supply path at the time of extraction and insertion with the ink tanks at the time of exchange of an ink tank etc., and a recording head.
[0005] Then, what was indicated by JP,3-61592,B is known as a proposal for suppressing the effect of the air conventionally mixed in the ink supply path in first stage at the time of extraction and insertion with an ink tank and a recording head. The ink tank which held the deaerated ink in the very high hermetic container of gas barrier property is held in the state of reduced pressure. In this conventional example, immediately after opening a hermetic container, the ink in an ink tank is deaeration ink, and it is going to remove the effect of the air mixed in the ink supply path in this deaeration ink in first stage.
[0006] However, it is the position difference of an ink tank, a location, connectability, etc., and this hermetic container structure does not have a degree of freedom, and is complicated. Moreover, with actuation of carriage, ink rocks violently and produces nonconformity in the regurgitation property of a recording head.
[0007] In order to solve this, the ink tank which contained the porosity member is proposed. On this ink tank, it has an injected hole for being filled up with ink, and an air hole for being open for free passage with atmospheric air so that air may flow corresponding to reduction by the

activity of ink.
[0008] Moreover, in order to make it deaeration ink as mentioned above, ink is filled up with a reduced pressure condition and an ink tank is made to pack in a container in the state of reduced pressure further.

## EFFECT OF THE INVENTION

[Effect of the Invention] Since an ink tank is sealed in the state of reduced pressure, while ink is re-deaerated according to this invention, the leakage of the ink in the time of vacuum packaging and transport or a state of preservation is lost. Moreover, since vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container, the gas which occurred in disassembly of ink from the interior of an ink tank is also gradually absorbed in vacuum packaging through a case, and can supply the ink deaerated by the very reliable condition in early stages of the activity of an ink tank by that cause to a recording device. Nonconformity with the air which this mixes in an ink supply way at the time of exchange of an ink tank is canceled.
[0049] Moreover, since it can inspect visually before packing the decompressed ink tank, inspection between processes, such as ink leakage and deformation of a case, becomes easy.
[0050] Furthermore, it is effective in suppressing the ink evaporation at the time of a real activity to the minimum by covering the top face of the ink tank 7 by the closure member of non-permeability.
[0051] An ink jet recording device with it can be offered by the above. [ it is reliable and very, small ]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the conventional example, when whenever [ reduced pressure ] tends to be more large although it was good when the surface tension of ink was comparatively high and it was hard to foam, whenever [ deaeration ] tends to be maintained and it is going to raise dependability, or in the surface tension of ink is low and being easy to foam, ink leakage-comes to be easy from an injected hole. Moreover, if vacuum packaging is carried out after adding the impact of being as drop ****, since ink will leak by slight reduced pressure, workability is bad. If there is furthermore a temperature change, ink will leak by expansion of the gas in ink. In order to prevent the leakage of ink, when the fill of ink is reduced and a charging efficiency is dropped, there is a problem that an ink tank becomes large.
[0010] Moreover, even if it prepares space into an ink tank, or devises the configuration of a lid and copes with leakage, under hot environments, the gas in ink expands and leaks and preventing this thoroughly has the problem that an ink tank becomes large, in a difficult top.
[0011] Then, the place which this invention solves such a trouble and is made into the object has dependability in offering a small high ink jet recording device.

MEANS

[Means for Solving the Problem] In the ink jet recording device which the ink jet recording device of this invention supplies ink through a free passage member from an ink tank, and records an ink droplet on the discharge detail paper from a nozzle The free passage section which an ink tank opens for free passage to ink ****, ink ****, and a recording head, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and this each free passage hole are closed so that it may be in a reduced pressure condition. It is characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads an ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[0013] In the ink tank which the ink tank of this invention loads with an ink droplet from a nozzle the ink jet recording device which records on the discharge detail paper, and supplies ink to a recording head The free passage section which an ink tank opens for free passage to ink ****, ink ****, and a recording head, One piece thru/or two or more free passage holes dug so that it might be open for free passage with the exterior, and this each free passage hole are closed so that it may be in a reduced pressure condition. It is characterized by consisting of a container which consists of closure members of the non-permeability which can be opened just before at least one piece loads an ink jet recording device, prepares space further, and is packed in the state of reduced pressure.
[0014] Ink **** which uses the manufacture approach of the ink tank of this invention for an ink jet recording device, In the manufacture approach of an ink tank of having the free passage section which is open for free passage to the free passage hole dug so that it might be open for free passage with the exterior, and ink **** and an ink jet recording device A. -- process C. which supplies and fills up an ink tank with the process B. ink which decompresses this ink **** through a free passage hole from a free passage hole -- by the closure member of the non-permeability which can open at least one piece It is characterized by consisting of a process which at least one piece puts in the process D. ink tank which seals by decompressing so that ink **** may be in a reduced pressure condition in a container without permeability, decompresses the inside of a container, and carries out a seal package among each free passage holes.
[0015] Moreover, said process of C and D is characterized by the thing of 0.02-0.05MPa mostly performed by this draft.
[0016] It is characterized by consisting of a process which carries out this stop of the closure member to un-sealing in the state of a tacking meal and reduced pressure under atmospheric pressure, and furthermore makes seal at least one of a free passage hole in the state of reduced pressure into a container.

OPERATION

[Function] Since an ink tank is sealed in the state of reduced pressure, while ink is re-deaerated according to the above-mentioned configuration of this invention, the leakage of the ink in the time of vacuum packaging and transport or a state of preservation is lost. Moreover, since vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container, from the interior of an ink tank, the gas which occurred in disassembly of ink

is also gradually absorbed in vacuum packaging through a case, and, thereby, is deaerated by the very reliable condition in early stages of the activity of an ink tank. Nonconformity with the air which this mixes in an ink supply way at the time of exchange of an ink tank is canceled.
[0018] Moreover, since it can inspect visually before packing the decompressed ink tank, inspection between processes, such as ink leakage and deformation of a case, becomes easy.
[0019] Furthermore, the ink evaporation at the time of a real activity can be suppressed by covering the top face of the ink tank 7 by the closure member of non-permeability to the minimum.

## EXAMPLE

[Example] One example of this invention is explained based on a drawing below.
[0021] Drawing 1 is a main sectional view for explaining one example of the ink jet recording apparatus of this invention, and drawing 2 is the decomposition perspective view of the body of the ink tank used for the ink jet recording apparatus of this invention. Drawing 3 shows the perspective view of the body. Moreover, drawing 4 is a block diagram for explaining ink and a detector. A platen 1 is approached and the recording head 3 is formed in the carriage 2 which reciprocates a guide shaft 2a top in the direction of arrow-head B along with the platen 1 which is a recording paper conveyance means to rotate in the direction of arrow-head A in order to convey the recording paper in one. The ink tank 7 which held form 6a which there is ink **** 6 and becomes the interior from porosity members, such as polyurethane foam, is formed above the recording head 3. In this example, the ink tank 7 is divided into three chambers, 6Y, 6M, and 6C, and three ink **** 6 are formed. These chambers of each are filled up with yellow, cyanogen, and the color ink of a Magenta. However, if the class and number of ink change on a design, the number of chambers in the ink tank 7 will be divided into a required number. The exterior and the free passage hole 9 open for free passage are formed in the lid 8, and the base-like projection 10 which aims at adhesion with form 6a is formed in the base at the ink tank 7. There is the free passage section which turns caudad from the core of this projection 10, and is open for free passage to a recording head 3. The free passage section is formed in the edge of the ink room 11 which carries out ejection maintenance of the ink in form 6a, and the ink room 11 by the plug 12 which consists of elastic members, such as rubber. And by inserting in this plug 12 the hollow needle 5 which are a recording head 3 and a free passage member open for free passage through the filter room 4, it is constituted so that the ink which sank in into the ink tank 7 may be supplied to a recording head 3. In addition, the ink room 11 is in the condition of a sealing room by the plug 12 and form 6a. Moreover, it is closed till just before an activity by the closure member 21 of the non-permeability which at least one can open of the free passage hole 9, opens just before an activity, and is set to air hole 9a. However, although two or more free passage holes 9 are formed in this example, it is satisfactory for acquiring desired effectiveness at least each one chamber in any way. If the approach of pulling, removing and opening the edge using the closure member 21 long enough like drawing 2 is used in order to open, it can open easily. Furthermore, if the edge is joined into a container 25, when taking out from a container 25, it is surely opened, and there are also no problems, such as an opening failure of a user, and it can open certainly. Moreover, projection 31 is formed in the lever 30 for attaching an ink tank like drawing 5 , and when attaching an ink tank, even if it uses the approach of breaking through

a lever 30 by the derrick down and this projection 31 in the direction of C, it can open easily. However, if it is the configuration that the closure member 21 can be opened, it is not necessary to open using the instrument of dedication especially. The closure member 22 of non-permeability is formed in other free passage holes 9 which are not opened.

[0022] The reason for opening the closure member 21 here and opening air hole 9a is explained. The inside of an ink tank becomes negative pressure gradually as all the closure members 21 and 22 use a printer, since there are few air contents filled up in an ink tank to the ink consumption speed of the usual printer activity because of non-permeability. If this negative pressure exceeds constant value (i.e., if the negative pressure exceeding the capillary tube force of the meniscus of the ink formed in the nozzle of a head occurs in an ink tank), it will destroy and a meniscus will become the poor regurgitation of an ink droplet. Therefore, air hole 9a for filling up air corresponding to consumption of ink is needed.

[0023] Moreover, when the poor regurgitation arises in a recording head 3, ink should be attracted from a recording head 3 in operating a suction pump 15 through cap 13 and piping 14. Thereby, recovery action of the poor regurgitation is performed. The attracted ink is sent to waste ink ** 17 through piping 16. In this invention, waste ink ** 17 and the ink tank 7 are another objects, and waste ink ** 17 is arranged in the body of a recording device, and has the composition of usually not being exchanged.

[0024] By the way, the signs S1 and S2 in drawing are ink and an electrode for detection, the electrode S1 of one of these was formed in the internal surface of the ink tank 7 so that form 6a might be contacted, and the hollow needle 5 with which the electrode S2 of another side contacts ink serves as the electrode. O ring 24 made of rubber makes it have bit so that ink may not leak between an electrode S1 and the ink tank 7. And as shown in drawing 4 , the seal of approval of the reference voltage Vcc is carried out to an electrode S1. Moreover, the hollow needle 5 which serves as the electrode S2 of another side is grounded. Furthermore, the resistance variation detector which consists of a differential circuit 19 and a comparison circuit 20 has connected with the electrode S1 of the side to which the seal of approval of the reference voltage Vcc is carried out. And when fixed level with resistance variation is exceeded, it is constituted so that an output signal may be generated.

[0025] Moreover, the record command signal for expulsion of an ink droplet by which a seal of approval is carried out to a recording head 3 is transmitted by FPC (Flexible Print Circuit)18 which is a flexible signal means of communication. And on FPC18, ink and the signal line for detection are wired in one, and it connects with electrodes S1 and S2. In addition, the thing of FPC18 for which FFC (Flexible Flat Cable) etc. may be used for replacing cannot be overemphasized as a signal means of communication. It cannot be overemphasized that you may be the configuration of the two-sheet pile instead of FPC of one more sheet.

[0026] Next, the flow chart of drawing 6 explains the manufacture approach of the ink tank used for this example.

[0027] Like an ink tank erector, it leaves the closure members 21 and 22 and the ink tank 7 which consists of a configuration of above-mentioned drawing 2 is assembled.

[0028] At an ink ****** reduced pressure process, it lets the free passage hole 9 pass, and ink ****** 6 of the ink tank 7 is decompressed to 0.04 or less MPas. Whenever [ reduced pressure / at this time ] has 0.02 or less desirable MPas, when the amount of restoration ink and an injection time are taken into consideration.

[0029] Then, ink is filled up with an ink restoration process from the free passage hole 9. At this time, ink is decompressed and turns into deaeration ink. An ink packing effect is a very high

approach as how to fill up ink with this reduced pressure condition into a porosity member is indicated and explained in JP,60-245560,A.

[0030] Next, ** is carried out except 9a by the closure member 22 among the free passage holes 9 under atmospheric pressure. Then, the ink tank 7 is made into the bottom of reduced pressure of 0.02-0.05MPa at a reduced pressure seal process, and ** is carried out for air hole 9a by the closure member 21. If it is under this reduced pressure, ink will be re-deaerated enough and there will be no ink leakage from air hole 9a. If whenever [ reduced pressure ] is set to 0.02 or less MPas, ink leakage will occur by few impacts after the ink leakage at the time of reduced pressure, or the above-mentioned seal, the position difference, environmental temperature change, etc.

[0031] After [ closure ] atmospheric-air disconnection is carried out. Like drawing 7 , this process may carry out 21b stop of the 21a of the closure member 21 under a tacking meal and reduced pressure of 0.02-0.05MPa under atmospheric air, and is easy this gentleman on equipment.

[0032] Thus, the ink of the sealed ink tank 7 is re-deaerated while homogeneity is filled up with the atmospheric-air disconnection and re-reduced pressure after restoration at form 6a of a porosity member.

[0033] Although the approach by joining or the binder etc. can be used for the closure approach, the joining is more desirable in order to prevent the leakage of ink. When using adhesives, it is necessary to satisfy the adhesive strength for preventing leakage, detachability, and the property of not being committed by ink.

[0034] It is the member of non-permeability, and the closure members 21 and 22 make a subject polyethylene terephthalate resin or an aluminum laminate film, and are joining or a laminated film which consists of polystyrene resin, polyolefine system resin, etc. so that it may be easy to paste up.

[0035] Next, in a reduced pressure packaging process, after putting the ink tank 7 and a spacer 28 into a container 25 like drawing 8 and decompressing to 0.02-0.05MPa, the seal of the seal section 26 is carried out thoroughly, and a seal package is carried out. Atmospheric-air disconnection is carried out after that.

[0036] Space 29 is between the ink tank 7 and a container 25. Even if ink decomposes during transport of the ink tank 7 and preservation and gas, such as nitrogen and oxygen, occurs, it is gradually deaerated through a case wall by this space 29. If the member to which air is penetrated like a corrugated fiberboard or urethane foam to a spacer 28, and space exists in the interior is used, even if a container 25 sticks, the space in a member will play the role of space 29. Moreover, a role of shock absorbing material which protects the ink tank 7 is also played. Whenever [ reduced pressure / at the time of vacuum packaging ] is the almost same 0.02-0.05MPa as whenever [ reduced pressure ] at the time of closure of said closure member 21. Pressure balancing in an ink tank and a hermetic container is maintained by this, and even if the bonding strength of joining or the closure members 21 and 22 which were pasted up is small on the ink tank 7, it does not separate.

[0037] The hermetic container by which the reduced pressure seal package was carried out is shown in drawing 9 . A container 25 is the package bag made from the very high aluminum laminate film of gas barrier property.

[0038] Furthermore, it is contained by the container 27 (un-illustrating) at a packing process. This condition was [ the seal section 26 of a container 25 ] of use in the container 27, and it serves as shock absorbing material. Therefore, it is not necessary to use a special buffer member.

[0039] Next, the relation between the degree of vacuum at the time of vacuum packaging and the nitrogen volume after the retention period in a vacuum-packaging condition is explained. What is necessary is just to be able to control nitrogen volume, since nitrogen volume is the largest although gases other than nitrogen also exist in atmospheric air.
[0040] According to the experiment, by controlling whenever [ reduced pressure / at the time of a seal seal ] to be shown in a table 1, whenever [ deaeration / of the ink in the ink tank 7 immediately after opening a package ] is controllable.
[0041]
[A table 1]

[0042] The percentage of nitrogen volume which has melted into the ink to a saturation value had shown the nitrogen volume in a table, and, in the case of the ink used for this example, the saturation value was about 10-11 ppm.
[0043] Next, based on experimental data, drawing 10 explains how whenever [ in the ink tank from the time of manufacture to a real activity / ink deaeration ] changes to the nitrogen volume in ink. The ink deaerated at the a event after ink restoration reaches a saturation state by being left in an ambient condition at the b event of about three days after. If the ink tank 7 is sealed by the closure member 21 of non-permeability under reduced pressure of 0.02-0.05MPa at the c event, it will deaerate, nitrogen and oxygen of the dissolution in ink will be further absorbed by the space 23 of the ink tank 7, and ink will become by whenever [ deaeration / at the d event ]. Since ink decomposes and gas, such as nitrogen in an ink component, occurs after that, whenever [ deaeration ] falls. Although the period of d event is based also on a circumference environment, it is about one day and increases 10 to 20% at the e event over one year from six months. If vacuum packaging is carried out at the e event, whenever [ ink deaeration / of the ink tank 7 ] will improve gradually through the case of the ink tank 7 etc. Space 29 can be made to also absorb enough the gas from the ink generated during a long period of time. The period of e event to f event is a retention period in a package condition, and assumed two years in the experiment.
[0044] And nitrogen volume rises one by one from the event among [ after opening / f ] drawing. The nitrogen volume in ink will reach the abbreviation saturation state in [ g ] drawing after opening in about three days. However, according to the experiment, it turned out that the effectiveness by deaeration is expectable about two to four weeks after opening in [ f ] drawing (inside h of drawing). It will be in a perfect saturation state after that, and the effectiveness of deaeration of the ink for which it asks by this invention is lost.
[0045] Although each event established sufficient period and was performed in this experiment, in order to carry out closure at the c event under reduced pressure within several hours after the ink restoration at the a event and to perform vacuum packaging at the e event to a pan within one day in a real production process, it is N2 like a graphic display. A value change is not seen, but vacuum packaging is carried out where whenever [ deaeration ] is maintained enough.

[0046] Here explains the effectiveness by deaeration of ink. In case the ink tank 7 is taken out and inserted to the hollow needle 5, the amount of the air mixed from the hollow needle 5 is very usually a minute amount. In the check by experiment, when the ink inflow aperture of the hollow needle 5 was a diameter of about 0.8mm, even if there were many amounts of the air to mix, they were below 0.4 cube mm extent for a meniscus. The air mixed once flows toward a recording head 3, and a trap is reached and carried out to filter 4a in the filter room 4 (un-illustrating). Since this air by which the trap was carried out has the very detailed eye granularity of filter 4a, filter 4a is not passed easily. When the diameter of filter 4a was [ the space width of face in 4mm and the filter room 4 ] about 0.3-0.5mm according to the experiment, even if the count of extraction and insertion of the ink tank 7 carried out 10 - ten numbers, this air did not pass filter 4a by record actuation. In case deaeration ink can be clearly supplied to a recording head 3 during the period to the inside g of drawing 10 if it is mixing of air of this level, and this takes out and inserts the ink tank 7 to the hollow needle 5, the air mixed from the hollow needle 5 melts into ink, and does not pose a problem. However, when left removing the ink tank 7 from the hollow needle 5 in a real activity, it is fully possible. In this case, air mixes in a large quantity. The air mixed when air mixed in the large quantity will close filter 4a, and will bar passage of ink. A recording head 3 becomes the poor regurgitation as the result. In this case, although the suction pump 15 was operated and recovery action of the poor regurgitation was performed, the experiment also showed that a big difference was in recoverability by whenever [ deaeration / of ink ]. If it is ink by about two - four weeks after opening shown in [ h ] drawing 10 , there will be no nonconformity in carrying out attraction clearance of the air in the filter room 4 with a suction pump 15 in any way. However, when it passed over this period, and it changed into the supersaturation condition further and filter 4a was passed with air, as for the air content in ink, it was checked full saturation and that apply to a recording head 3 from filter 4a, and minute air bubbles are generated. It will become the poor regurgitation when these minute air bubbles are in the pressure room of a recording head 3.

[0047] To the air mixed at the time of exchange of the ink tank 7 as explained above, nonconformity which becomes poor [ the regurgitation ] according to the effectiveness of deaeration of ink can be abolished. Moreover, also in the recovery action performed when air collects so much in the filter room 4, recovery action can be ended good according to the effectiveness of deaeration of ink. If the air content in the filter room 4 is below fixed, in order that air may not pass filter 4a with ink, even if it is ink used as the saturation state after among [ g ] drawing 10 , there is no nonconformity in any way at the time of recovery action.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The main sectional view for explaining one example of the ink jet recording device of this invention.

[Drawing 2] The decomposition perspective view of the body of the ink tank used for the ink jet recording device of this invention.

[Drawing 3] The perspective view of the body of the ink jet recording device of this invention.

[Drawing 4] The block diagram for explaining ink and a detector.

[Drawing 5] The perspective view of the body of the ink jet recording device of this invention.

[Drawing 6] The flow chart explaining the production process of this invention.
[Drawing 7] The perspective view explaining closure by the closure member of this invention.
[Drawing 8] The sectional view for explaining the inside of a reduced pressure container.
[Drawing 9] The perspective view for explaining the ink tank by which vacuum packaging was carried out.
[Drawing 10] Drawing having shown nitrogen volume and the relation of time amount.
[Description of Notations]
3 .... Recording Head
6 .... Ink ******
6a .... Form
7 .... Ink Tank
9 .... Free Passage Hole
9a .... Air hole
21 .... Closure member
22 .... Closure member
23 .... Space
25 .... Container
26 .... Seal section
28 .... Spacer
29 .... Space